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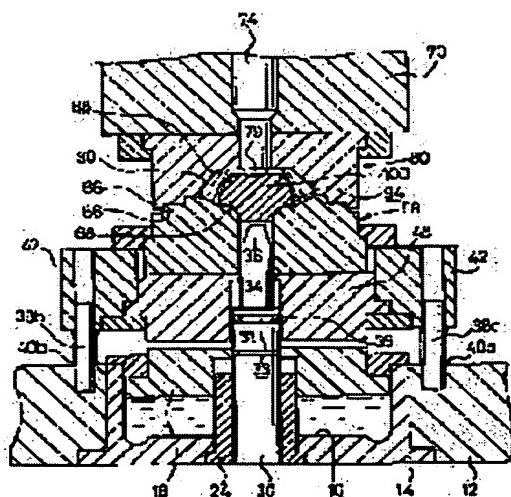
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(54) METHOD AND DEVICE FOR FORGING OF BEVEL GEAR

(57) Abstract:

PROBLEM TO BE SOLVED: To provide a method and device for forging of a bevel gear by which a forged part is obtained without damaging a tooth-form formed to an upper die, with improving durability of the upper die and without generating burr, forming defect, etc., in forging.

SOLUTION: A lower part of a preform 100 is formed to a male/female shape of a bottom face side having no tooth form of a bevel gear to be produced. When the preform 100 is placed in a lower die 58, a tip part 36 of a lower punch 34 is apart in a prescribed spacing from the preform 100. The lower die 58 and upper die 80 are closed under descending action of the upper die 80. At this time, the upper part of the preform 100 is apart from a tooth form 90 formed to the upper die 80. When the punch 34 is advanced into a cavity 94, the preform 100 is pressed by the punch 34 to be subjected to plastic deformation and upsetting to the wall part of the cavity 94, thus, a bevel gear is formed.



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CLAIMS

[Claim(s)]

[Claim 1] The process which lays a work piece in female mold in the condition of having estranged from lower punch, in the approach for fabricating bevel gear with forging shaping, The process which makes said female mold and punch blockade mutually where the tooth form which female mold and a punch were made to contact and was formed in this punch is estranged from said work piece, The forging shaping approach of the bevel gear characterized by having the process which this lower punch is made to advance into the cavity formed between said female mold and punches, presses said work piece, and carries out swaging shaping of said work piece by moving said female mold and punch to said lower punch relatively.

[Claim 2] In the forging shaping approach of bevel gear according to claim 1 said work piece It is the preforming article with which the male-and-female configuration by the side of the base which does not have the tooth form side of the bevel gear manufactured in the inferior-surface-of-tongue side was fabricated. Said female mold is the forging shaping approach of the bevel gear which the inferior-surface-of-tongue side of said work piece and female mold are engaged, and are characterized by being positioned in case it has a sex configuration corresponding to the male-and-female configuration of said bevel gear and said work piece is laid in said female mold.

[Claim 3] the equipment for carrying out forging shaping of the bevel gear -- setting -- female mold and this female mold -- receiving -- approach -- it being able to estrange freely and with the punch which has the tooth form of the sex configuration corresponding to the male-and-female configuration of the tooth form of the bevel gear manufactured When it was prepared in the pore formed by said female mold, and it had relatively the lower punch which can be displaced freely to this female mold, this work piece and said lower punch carry out predetermined spacing alienation when a work piece is laid in said female mold, and female mold and a punch are made to blockade The tooth form of this punch is forging shaping equipment of the bevel gear characterized by having estranged with said work piece.

[Claim 4] It is forging shaping equipment of the bevel gear which said female mold has a sex configuration corresponding to the male-and-female configuration by the side of a base without the tooth form side of the bevel gear manufactured in the forging shaping equipment of bevel gear according to claim 3, and are characterized by the work piece with which the male-and-female configuration of said bevel gear manufactured was formed engaging with said female mold.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the method of manufacturing the bevel gear

like the bevel gear used for the differential equipment of an automobile with forging shaping, and its equipment.

[0002]

[Description of the Prior Art] the female mold which has lower punch conventionally, and this female mold -- receiving -- approach -- it is constituted free [alienation] and the forging shaping equipment of bevel gear equipped with the punch which has upper punch is proposed. the wall which lays the work piece of the shape of a cylindrical shape cut by the cavity formed in said female mold at predetermined die length in order to have manufactured bevel gear using this forging shaping equipment, presses said work piece to lower punch and upper punch, and constitutes the cavity between a punch and female mold for this work piece -- swaging -- it fabricates. Generally this approach is called the forging shaping approach of both force pistons.

[0003] the female mold which has lower punch on the other hand, and this female mold -- receiving -- approach -- it has the punch which can be estranged freely, and the work piece laid in female mold is pressed with lower punch, and the forging shaping approach of the piece force piston which sets this work piece on the wall which constitutes a cavity is also proposed from the former. However, by the forging shaping approach of both the aforementioned force pistons, it is easy to generate weld flash with the forging material which turns to the gap of female mold and lower punch, and the gap of a punch and upper punch, and the process which removes this weld flash by cutting is needed. Moreover, by the forging shaping approach of a piece force piston, there was a fault that poor shaping tends to generate that it is difficult to fully carry out plastic deformation of the work piece, and the under-fill section will arise etc.

[0004] It is constituted free [alienation]. the female mold which has lower punch that it should conquer this kind of un-arranging, and this female mold -- receiving -- approach -- Have the punch which has predetermined tooth form and the preforming article of the configuration which gave preforming to the cylindrical shape-like work piece and was approximated to bevel gear is once fabricated. This preforming article is supported with lower punch, the pressure welding of the punch is carried out to female mold, said preforming article is pinched by the state of obstruction, and the method of obtaining swaging and bevel gear to the wall which constitutes a cavity for the preforming article concerned is also proposed by pressing lower punch in this preforming article.

[0005] Furthermore, the upper limit of a work piece is made to project in predetermined height from the end face of the 1st mold as indicated by JP,7-100578,A. Turn and carry out the variation rate of the 2nd mold to said 1st mold, carry out plastic deformation of the upper limit of said work piece, and said the 1st mold and 2nd mold are blockaded. The variation rate of the punch is relatively carried out to shaft orientations to the 1st mold and 2nd mold, and the method of manufacturing swaging and bevel gear is proposed in said work piece by the wall which constitutes the cavity of the 1st mold and the 2nd mold.

[0006] Further again as indicated by JP,7-236937,A It has the punch in which upper punch was prepared, and the female mold formed free [displacement of lower punch]. Press the upper part of a work piece to upper punch, and primary press forging is given to the bottom of the depressor activity of a punch. The method of carrying out a flow variation rate to the addendum part of the bevel gear which are made to carry out a flow variation rate to a bottom part at least, lower punch is made to advance into a cavity, press a work piece, give secondary press forging, and manufacture a forging material of the bevel gear which manufacture a forging material, and manufacturing bevel gear is proposed.

[0007]

[Problem(s) to be Solved by the Invention] The tooth form formed in the punch when a punch carried out a pressure welding to female mold is made to press and transform the part in which the tooth form of a preforming article is formed by the forging shaping approach of the bevel gear concerning the above-mentioned conventional technique. For this reason, the force strong against the tooth form of a punch was added, there was concern which the tooth form currently

formed in this punch damages, and there was a problem that the endurance of a punch became short.

[0008] It aims at offering the forging shaping approach of the bevel gear which this invention is made that the aforementioned technical problem should be solved, it does not do damage to the tooth form formed in the punch, and its endurance of a punch improves, and generating of weld flash and poor shaping do not generate at the time of forging shaping, and its equipment.

[0009]

[Means for Solving the Problem] In an approach for this invention to fabricate bevel gear with forging shaping, in order to attain the aforementioned purpose The process which makes said female mold and punch blockade mutually where the process which lays a work piece in female mold in the condition of having estranged from lower punch, and the tooth form which female mold and a punch were made to contact and was formed in this punch are estranged from said work piece, It is characterized by having the process which this lower punch is made to advance into the cavity formed between said female mold and punches, presses said work piece, and carries out swaging shaping of said work piece by moving said female mold and punch to said lower punch relatively.

[0010] According to this invention, when a work piece is laid in female mold, this work piece is estranged from lower punch. If a punch is dropped to this work piece and this punch and female mold of each other are blockaded, since the tooth form formed in the punch is estranged from the work piece, an impact in case a punch and female mold contact will not join this tooth form. And if lower punch is made to advance into a cavity, the work piece inside this cavity will be pressed, and will be deformed plastically, it will flow that there is no clearance in the tooth form of said punch, and bevel gear will be fabricated.

[0011] In this case, it is the preforming article with which the male-and-female configuration by the side of the base which does not have the tooth form side of the bevel gear manufactured in that inferior-surface-of-tongue side was fabricated, and if female mold is engaged the inferior-surface-of-tongue side of said work piece in case it has a sex configuration corresponding to the male-and-female configuration of said bevel gear and said work piece is laid in said female mold, said female mold can be positioned easily and is suitable for said work piece. In equipment for this invention to carry out forging shaping of the bevel gear Moreover, female mold, this female mold -- receiving -- approach -- it being able to estrange freely and with the punch which has the tooth form of the sex configuration corresponding to the male-and-female configuration of the tooth form of the bevel gear manufactured When it was prepared in the pore formed by said female mold, and it had relatively the lower punch which can be displaced freely to this female mold, this work piece and said lower punch carry out predetermined spacing alienation when a work piece is laid in said female mold, and female mold and a punch are made to blockade Tooth form of this punch is characterized by having estranged with said work piece.

[0012] According to this invention, a work piece is laid in female mold in the condition that this work piece and said lower punch have estranged, a punch is dropped, and this punch and female mold are made to blockade. If said lower punch is made to advance into a cavity, said work piece will be deformed plastically, it will flow that there is no clearance in the tooth form of said punch, and bevel gear will be fabricated. Moreover, said female mold has a sex configuration corresponding to the male-and-female configuration by the side of a base without the tooth form side of the bevel gear manufactured in this case, and if the work piece with which the male-and-female configuration of said bevel gear manufactured was formed engages with said female mold, in case a work piece will be laid in the cavity of female mold, positioning becomes easy and it is suitable.

[0013]

[Embodiment of the Invention] It explains to a detail below, mentioning the gestalt of suitable operation in relation with the equipment which carries it out, and referring to an attached drawing about the forging shaping approach of the bevel gear concerning this invention. The

case where the bevel gear used for an automobile is manufactured is mentioned as an example, and the gestalt of this operation explains it.

[0014] In drawing 1, a reference mark 10 shows the forging shaping equipment of the bevel gear concerning the gestalt of this operation. The forging shaping equipment 10 of these bevel gear contains the female mold attachment member 12. A hydraulic power package 14 is formed in the center section of this female mold attachment member 12, and a pressure oil is supplied to ** 16 formed inside this hydraulic power package 14 from the pressure-oil source of supply which is not illustrated. The press member 18 is formed in the aforementioned room 16 free [vertical movement], and this press member 18 is pressed up by said pressure oil in drawing. A step 20 is formed in the upper part of said press member 18, and the presser-foot member 22 which fixed in the upper part of said hydraulic power package 14 engages with this step 20. Therefore, as for said press member 18, the migration to the upper part is controlled by said presser-foot member 22. The tubed part material 24 is formed in the center section of said hydraulic power package 14, and the upper limit section of this tubed part material 24 is inserted in the crevice 26 formed by the center section of said press member 18. Knock out pin 30 is inserted into the central pore 28 of this tubed part material 24. The cylinder member 31 of the knock out pin 30 and the diameter of said concerned contacts the upper part of this knock out pin 30, a slot 33 is formed by the outer wall of this cylinder member 31, and O ring 35 is formed in this slot 33. Said knock out pin 30 and the cylinder member 31 are further projected up from the pore 32 formed by the upper part of said crevice 26. In the upper limit section of said cylinder member 31, the lower punch 34 of the shape of a cylinder [minor diameter / member / 31 / this / cylinder] fixes, the diameter of the point 36 of this lower punch 34 is reduced towards the upper part, and it is presenting the taper configuration.

[0015] Stanchions 38a and 38b are set up by the upper part of said female mold attachment member 12, these stanchions 38a and 38b are surrounded, and coiled spring 40a and 40b is formed. The pressure welding of the upper limit section of said coiled spring 40a and 40b is carried out to the maintenance plate 42. Said stanchions 38a and 38b are actually inserted in the pores 44a and 44b formed by this maintenance plate 42 free [sliding], and the maintenance plate 42 concerned can move up and down freely along with these stanchions 38a and 38b by this. Therefore, it will be understood easily that said coiled spring 40a and 40b is energizing said female mold attachment member 12 and said maintenance plate 42 in the direction estranged mutually. The osculum 46 which has a level difference in the center of said maintenance plate 42 is formed, and a punch holder 48 inserts in the lower part of this osculum 46. The flange 50 is formed in this punch holder 48. It presses down to this flange 50 and a member 52 is engaged, and when this presser-foot member 52 fits into the lower part of said maintenance plate 42, said punch holder 48 is held at the maintenance plate 42. The crevice 54 where said cylinder member 31 can slide on the center section of this punch holder 48 freely is formed, the pore [minor diameter / crevice / 54 / concerned] 56 is formed by the upper part of this crevice 54, and said lower punch 34 inserts in this pore 56 free [sliding] relatively.

[0016] Female mold 58 is formed so that a laminating may be carried out to said punch holder 48. A step 60 is formed in the outer wall of this female mold 58, the positioning member 62 actually engages with this step 60, and when this positioning member 62 fixes in the upper part of said maintenance plate 42, positioning immobilization of the female mold 58 is carried out at said maintenance plate 42. Said pore 56 and the pore 64 which is open for free passage in same axle are formed by the center section of said female mold 58, and said lower punch 34 is relatively inserted in this pore 64 free [sliding]. A step 66 is formed in the periphery marginal top face which projects from said positioning member 62 of said female mold 58, and this step 66 has the shape of a taper whose diameter was slightly reduced toward the upper part. The installation section 68 is formed in the central part of said female mold 58, this installation section 68 is turned caudad, and the diameter of it is reduced, and it is open for free passage with said pore 64. Said installation section 68 is formed in the sex configuration corresponding to the

male-and-female configuration by the side of the base in which the tooth form of the bevel gear manufactured and the opposite side, i.e., the tooth form side of bevel gear, are not formed. [0017] this forging shaping equipment 10 -- said female mold attachment member 12 -- receiving -- approach -- it has the punch attachment member 70 which can be estranged freely. A pore 72 is formed by the center section of this punch attachment member 70, and upper punch 74 is inserted in this pore 72. Since the ramp 76 whose diameter turns this pore 72 caudad and is reduced is formed and the taper section 78 whose diameter turns to said upper punch 74 caudad, and is reduced is formed on the other hand, this upper punch 74 being held at said punch attachment member 70, and falling out from a pore 72 is prevented. Heights 79 are formed in the lower limit section of said upper punch 74. A punch 80 is formed in the lower part of this punch attachment member 70. A step 82 is formed in the outer wall of this punch 80, and an attachment component 84 engages with this step 82. Said attachment component 84 fixes to said punch attachment member 70, and positioning fixing of the punch 80 is carried out by the flange 85 of this attachment component 84 at said punch attachment member 70. A step 86 is formed in the periphery marginal inferior surface of tongue of the punch 80 concerned in concentric circle with this punch 80, and this step 86 has the shape of a taper whose diameter turned caudad and was expanded slightly. A crevice 88 is formed by the inferior-surface-of-tongue center section of said punch 80, and the tooth form 90 of the sex configuration corresponding to the male-and-female configuration of the tooth form of the bevel gear manufactured is formed in the wall which constitutes this crevice 88. The pore 92 which is open for free passage to the pore 72 of the punch attachment member 70 above said crevice 88 was formed by said punch 80, said upper punch 74 inserted in this pore 92, and the heights 79 of this upper punch 74 are projected inside said crevice 88.

[0018] Said punch 80 descends, and as shown in drawing 2, when female mold 58 is blockaded, a cavity 94 is formed by the installation section 68 of said female mold 58, the point 36 of lower punch 34, the crevice 88 of a punch 80, and heights 79. The forging shaping equipment 10 of the bevel gear concerning the gestalt of this operation is constituted as mentioned above fundamentally, and is explained below in connection with the forging shaping approach which starts the gestalt of this operation about the actuation next.

[0019] First, forging shaping is given to a cylindrical shape-like work piece and the preforming article 100 is fabricated. At this time, the lower part of the preforming article 100 is fabricated corresponding to the male-and-female configuration by the side of a base without the tooth form side of the bevel gear manufactured. Through the above preparation processes, as shown in drawing 1, said preforming article 100 is laid in the installation section 68 of female mold 58. Since it is formed corresponding to the configuration by the side of a base without the tooth form side of the bevel gear with which said installation section 68 is manufactured at this time, it is possible to position the preforming article 100 easily in the installation section 68. The inferior surface of tongue of the preforming article 100 concerned is carrying out predetermined spacing alienation from the point 36 of lower punch 34 in that case.

[0020] Next, as shown in drawing 2, while a punch 80 descends in one with the punch attachment member 70 and the step 66 of female mold 58 and the step 86 of a punch 80 fit in, when each taper part of this step 66 and a step 86 is engaged, a punch 80 is positioned to female mold 58, and this female mold 58 and a punch 80 are blockaded. The pressure welding of the inferior surface of tongue of a punch 80 and the top face of female mold 58 is carried out by the resiliency of coiled spring 40a and 40b in that case. At this time, the tooth form 90 formed in the punch 80 is estranged from the upper part of the preforming article 100, and forging shaping is not given to this preforming article 100. That is, some gap is formed between said tooth form 90 and preforming articles 100, and both are not in contact. Therefore, the force does not join this tooth form 90, but there is no concern which the tooth form 90 concerned damages. Moreover, it has prevented that a hydraulic power package 14 demonstrates a cushion function, and absorbs an impact when female mold 58 and a punch 80 contact, and this female mold 58 and a punch

80 damage it.

[0021] Subsequently, if a punch 80 descends further as shown in drawing 3, coiled spring 40a and 40b degenerates, the maintenance plate 42 descends, female mold 58 and a punch 80 will descend with the preforming article 100 in the condition of having blockaded, and the lower part of a punch holder 48 will contact the upper part of the press member 18. And specified quantity discharge of the pressure oil is carried out through the pressure-oil source of supply which is not illustrated from a hydraulic power package 14, the press member 18 descends the interior of ** 16, and the preforming article 100 also descends. Since lower punch 34 does not descend at this time, this lower punch 34 will displace up relatively to female mold 58, and the point 36 of the lower punch 34 concerned carries out press penetration into a cavity 94. Therefore, the preforming article 100 deforms plastically and it is set on each wall of the installation section 68, a crevice 88, and heights 79. For this reason, some materials which constitute the preforming article 100 to the addendum part of the tooth form 90 of a punch 80 flow, poor shaping, such as under-fill, is not generated and the tooth form 102 corresponding to this tooth form 90 is formed.

[0022] Moreover, since a punch 80 and female mold 58 are maintaining the condition of having carried out the pressure welding by the resiliency of a hydraulic power package 14 and coiled spring 40a and 40b, at this time, it can prevent that weld flash occurs around the preforming article 100. Tooth form 102 is fabricated by the preforming article 100 as mentioned above. next, the preforming article 100 -- a hole -- dawn processing is performed. the hole used for this hole dawn processing -- dawn equipment 110 is explained.

[0023] This hole dawn equipment 110 is equipped with a die holder 112 as shown in drawing 4. The flange 113 was formed in the lower part of this die holder 112, and it engaged with the plinth which this flange 113 does not illustrate, and has fixed to this plinth. A crevice 114 is formed by the upper part of this die holder 112, and the pars basilaris ossis occipitalis of this crevice 114 is open for free passage with the pore 116. This pore 116 curves inside said die holder 112, and is carrying out opening to the outside of this die holder 112. The hole dawn die 118 is inserted in said crevice 114. this -- a step 120 is formed in the periphery of the hole dawn die 118, it presses down to this step 120, a member 122 is engaged, and this presser-foot member 122 fixes to said die holder 112. therefore, a hole -- it will be understood easily that the dawn die 118 is held at the die holder 112. While the crevice 124 which engages with the lower part of the preforming article 100 is formed by said upper part of the hole dawn die 118, a pore 126 is formed by the center section of this crevice 124, and this pore 126 is open for free passage with said pore 116.

[0024] this hole dawn equipment 110 -- said die holder 112 -- receiving -- approach -- it has the plinth 128 which can be estranged freely. Pores 130a and 130b are formed by the lower part of this plinth 128, and from said plinth 128, the tubed part material 132a and 132b extends caudad in these pores 130a and 130b, and fixes to them. In the lower limit section of this tubed part material 132a and 132b, disc-like plate-like part material ****s, it is concluded by 134a and 134b, and the flanges 136a and 136b projected from the outer wall of the tubed part material 132a and 132b to the method of outside by this plate-like part material are formed. Steps 138a and 138b are formed near the trailer of said pores 130a and 130b, in these steps 138a and 138b, said tubed part material 132a and 132b was surrounded, and the end section of coiled spring 140a and 140b has sat down.

[0025] In the lower part of said plinth 128, said coiled spring 140a and 140b is surrounded, the attachment member 142 fixes, a pore 144 is formed by the center section of this attachment member 142, and the supporter material 146 is inserted in this pore 144 in contact with said plinth 128. The diameter of the lower part of this supporter material 146 is reduced through a step 150, and the presser-foot member 152 inserted in said pore 144 engages with this step 150. A flange 153 is formed in this presser-foot member 152, when this flange 153 ****s to said attachment member 142 and fixes by 154, said supporter material 146 falls out and a stop is carried out. hole dawn punch 155 fixes in the lower part of the supporter material 146 -- having -

- this -- hole dawn punch 155 is inserted in the pore 156 formed by said presser-foot member 152.

[0026] The maintenance plate 157 is formed under said attachment member 142, Pores 158a and 158b are formed by this maintenance plate 157, and said tubed part material 132a and 132b is inserted in it free [sliding] at these pores 158a and 158b. Said pores 158a and 158b are expanded the diameter of and formed through Steps 160a and 160b, said flanges 136a and 136b engage with these steps 160a and 160b, and, as for said maintenance plate 157, migration in a lower part is prevented. On the other hand, the other end of said coiled spring 140a and 140b is in contact with the upper part of said maintenance plate 157, and this coiled spring 140a and 140b is energized in the direction which estranges said plinth 128 and maintenance plate 157 of each other.

[0027] A pore 162 is formed by the central lower part of said maintenance plate 157, through a step 164, a lower part expands the diameter of said pore 162, and it is formed. A stripper 168 is inserted in this pore 162, a flange 170 is formed in the periphery of this stripper 168, and this flange 170 engages with said step 164, and fixes said stripper 168 on said maintenance plate 157 by being concluded by **** 172. The crevice 174 which engages with the upper part of the preforming article 100 is formed by the lower part of said stripper 168. A pore 176 is formed by the center section of this crevice 174, and said hole dawn punch 155 inserts in it free [sliding] at this pore 176.

[0028] the hole used for the gestalt of this operation -- dawn equipment 110 is constituted as mentioned above fundamentally, and explains [next] the actuation. this hole of hole dawn equipment 110 -- the preforming article 100 with which tooth form 102 was fabricated is laid in the crevice 124 formed in the dawn die 118. If a plinth 128 descends in one with a stripper 168, the crevice 174 of this stripper 168 will engage with the upper part of the preforming article 100, and this preforming article 100 will be positioned to a stripper 168. if a plinth 128 furthermore descends, as shown in drawing 5 R>5, coiled spring 140a and 140b will be pressed to the maintenance plate 157 and a plinth 128 -- having -- degenerating -- a hole -- dawn punch 155 is pressed by said plinth 128 and the supporter material 146, and descends, and it projects caudad from the pore 176 of said stripper 168, and advances and pierces from the upper part of the preforming article 100, and a pore 178 is formed by said preforming article 100. the scrap 180 generated by forming this pore 178 at this time -- a hole -- the pore 126 formed by the dawn die 118 is inserted in, and it is discharged outside from a pore 116.

[0029] Bevel gear are manufactured as mentioned above.

[0030]

[Effect of the Invention] According to the forging shaping approach of the bevel gear concerning this invention, and its equipment, the following effectiveness and advantages are acquired. In case female mold and a punch are blockaded, the tooth form of a punch does not press a preforming article and the tooth form of a punch does not damage the upper part of a preforming article in order not to contact the tooth form formed in the punch. Therefore, since the endurance of a punch improves and a punch can use it for a long time, it becomes possible to make a manufacturing cost cheap.

[0031] Since there is no concern which poor shaping, such as under-fill, generates since a material flows to the addendum of the tooth form formed in the punch and a punch and female mold are carrying out the pressure welding, it becomes unnecessary furthermore, to be also able to prevent generating of weld flash and to perform cutting etc. For this reason, productive efficiency improves.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is drawing of longitudinal section showing the forging shaping equipment of the bevel gear concerning the gestalt of operation of this invention.

[Drawing 2] It is drawing of longitudinal section in the condition that the operation of the forging shaping equipment of **[drawing 1]** is shown, and a punch and female mold blockade.

[Drawing 3] It is drawing of longitudinal section in the condition that the operation of the forging shaping equipment of **[drawing 1]** is shown, and lower punch is advancing into the cavity.

[Drawing 4] the hole used for the forging shaping approach of the bevel gear concerning the gestalt of operation of this invention -- it is drawing of longitudinal section showing dawn equipment.

[Drawing 5] It is drawing of longitudinal section showing the operation of the hole dawn equipment of **[drawing 4]**.

[Description of Notations]

10 -- Forging shaping equipment 34 -- Lower punch

36 -- Point 58 -- Female mold

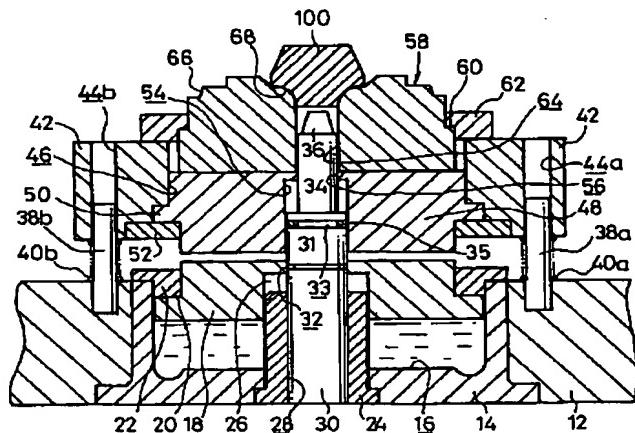
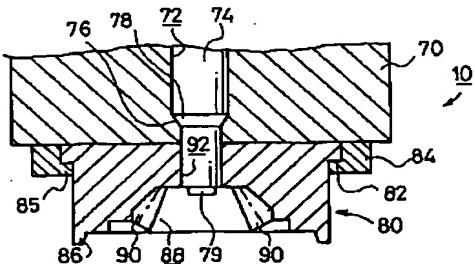
68 -- Installation section 80 -- Punch

90 -- Tooth form 100 -- Preforming article

DRAWINGS

[Drawing 1]

FIG.1



[Drawing 2]

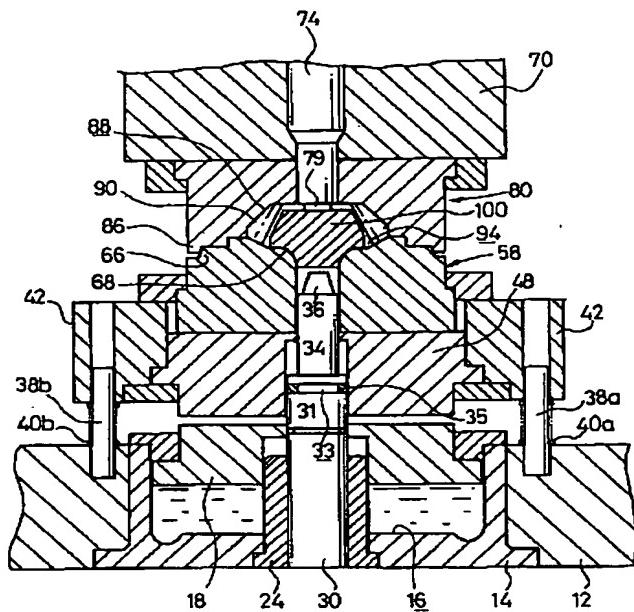
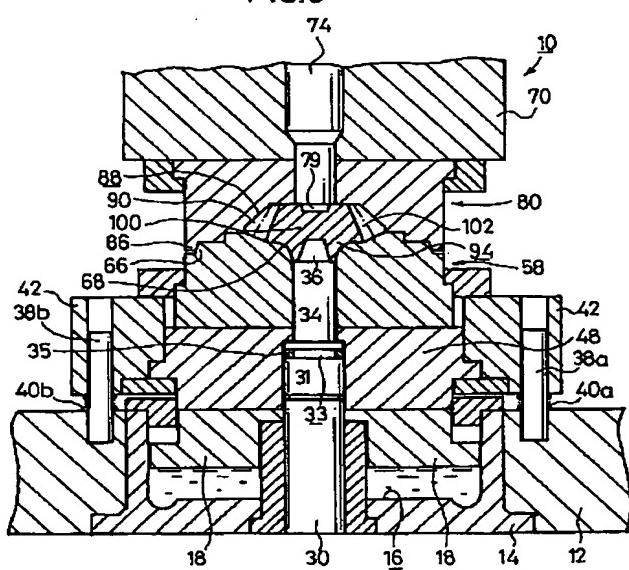
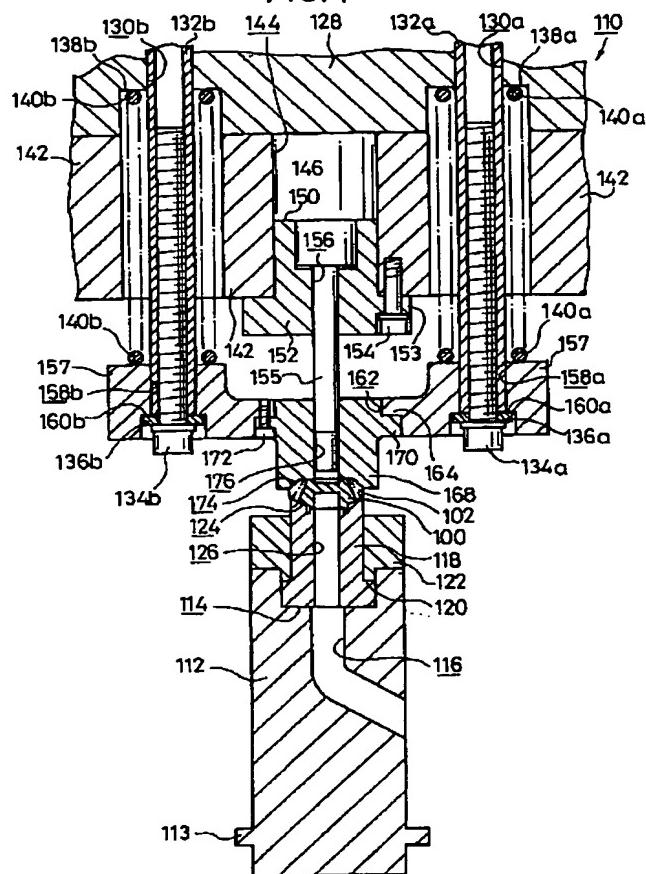
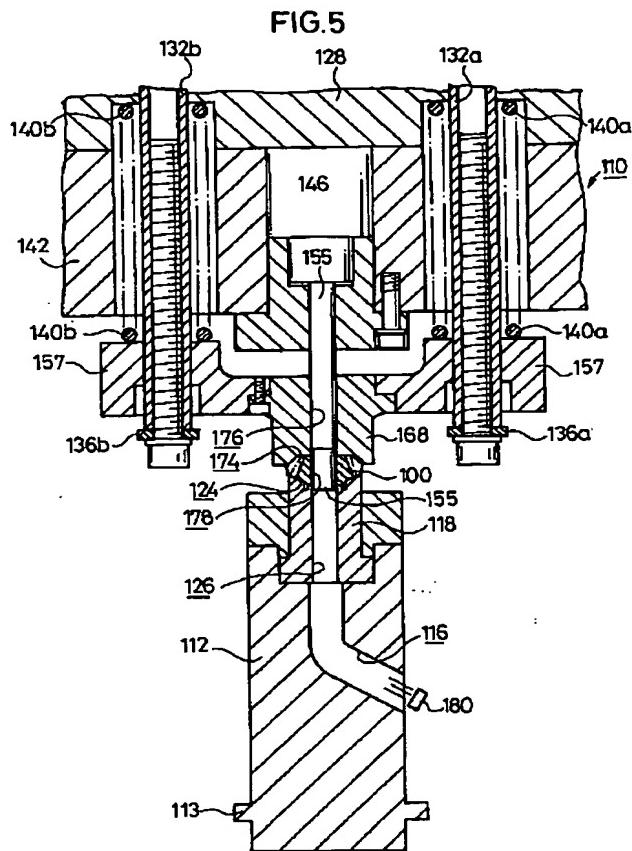
FIG.2**[Drawing 3]****FIG.3****[Drawing 4]**

FIG. 4



[Drawing 5]



[Translation done.]

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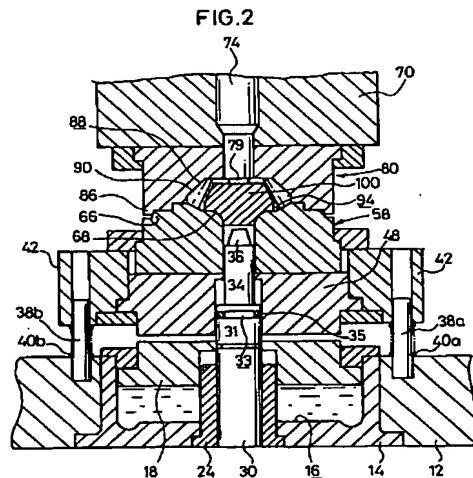
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(54)【発明の名称】 傘歯車の鍛造成形方法およびその装置

(57)【要約】

【課題】上型に形成された歯形に損傷を与えることがなく、鍛造成形品が得られ、しかも上型の耐久性が向上し、且つ、鍛造成形時にバリの発生、成形不良等が発生することのない傘歯車の鍛造成形方法およびその装置を提供する。

【解決手段】予備成形品100の下部は製造される傘歯車の歯形面のない底面側の雄雌形状に成形される。該予備成形品100を下型58に載置したときに、下ポンチ34の先端部36は当該予備成形品100から所定間隔離間している。上型80の下降作用下に前記下型58と上型80は閉塞する。このとき、前記予備成形品100の上部と前記上型80に形成された歯形90は離間している。前記下ポンチ34がキャビティ94に進入すると、前記予備成形品100は該下ポンチ34に押圧されて塑性変形し、前記キャビティ94の壁部にすえ込まれ、傘歯車が成形される。



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【特許請求の範囲】

【請求項1】傘歯車を鍛造成形により成形するための方法において、下ポンチから離間した状態でワークを下型に載置する工程と、

下型と上型を当接させ、該上型に形成された歯形を、前記ワークから離間した状態で前記下型と上型を互いに閉塞させる工程と、

前記下型と上型とを相対的に前記下ポンチに対して移動させることにより該下ポンチを前記下型と上型との間に画成されたキャビティに進入させて前記ワークを押圧して前記ワークをすえ込み成形する工程と、

を有することを特徴とする傘歯車の鍛造成形方法。

【請求項2】請求項1記載の傘歯車の鍛造成形方法において、

前記ワークは、その下面側に、製造される傘歯車の歯形面のない底面側の雄雌形状が成形された予備成形品であり、前記下型は前記傘歯車の雄雌形状に対応する雌雄形状を有し、前記下型に前記ワークを載置する際、前記ワークの下面側と下型とが係合し、位置決めされることを特徴とする傘歯車の鍛造成形方法。

【請求項3】傘歯車を鍛造成形するための装置において、下型と、

該下型に対して接近離間自在であり、製造される傘歯車の歯形の雄雌形状に対応した雌雄形状の歯形を有する上型と、

前記下型に画成された孔部内に設けられ、該下型に対して相対的に変位自在な下ポンチと、

を備え、ワークを前記下型に載置したときに該ワークと前記下ポンチは所定間隔離間し、下型と上型を閉塞させたときに、該上型の歯形は前記ワークと離間していることを特徴とする傘歯車の鍛造成形装置。

【請求項4】請求項3記載の傘歯車の鍛造成形装置において、

前記下型は、製造される傘歯車の歯形面のない底面側の雄雌形状に対応する雌雄形状を有し、製造される前記傘歯車の雄雌形状が形成されたワークが前記下型と係合することを特徴とする傘歯車の鍛造成形装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、例えば、自動車のディファレンシャル装置に使用されるペベルギアの如き傘歯車を、鍛造成形により製造する方法およびその装置に関する。

【0002】

【従来の技術】従来、下ポンチを有する下型と、該下型に対して接近離間自在に構成され、上ポンチを有する上型とを備えた傘歯車の鍛造成形装置が提案されている。

この鍛造成形装置を使用して傘歯車を製造するには、前

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記下型に形成されたキャビティに所定の長さに切断された円柱形状のワークを載置し、下ポンチと上ポンチで前記ワークを押圧して該ワークを上型と下型との間のキャビティを構成する壁部にすえ込み、成形する。この方法を、一般的に両押し型の鍛造成形方法と称している。

【0003】一方、下ポンチを有する下型と、該下型に對して接近離間自在な上型とを備え、下型に載置されたワークを下ポンチで押圧して該ワークをキャビティを構成する壁部にすえ込む片押し型の鍛造成形方法も從来から提案されている。ところが、前記の両押し型の鍛造成形方法では、下型と下ポンチとの間隙、上型と上ポンチとの間隙に回り込む鍛造素材によってバリが発生しやすく、このバリを切削加工により取り除く工程が必要になる。また、片押し型の鍛造成形方法では、ワークを十分に塑性変形させることが困難であり、欠肉部が生じてしまう等、成形不良が発生しやすいという欠点があった。

【0004】この種の不都合を克服すべく、下ポンチを有する下型と、該下型に對して接近離間自在に構成され、所定の歯形を有する上型とを備え、一旦、円柱形状のワークに予備成形を施して傘歯車に近似した形状の予備成形品を成形し、該予備成形品を下ポンチで支持し、上型を下型に圧接させて前記予備成形品を閉塞状態で挟持し、下ポンチを該予備成形品に押圧することにより当該予備成形品をキャビティを構成する壁部にすえ込み、傘歯車を得る方法も提案されている。

【0005】さらに、特開平7-100578号公報に開示されているように、ワークの上端を第1の型の端面から所定の高さに突出させ、第2の型を前記第1の型に向けて変位させ、前記ワークの上端を塑性変形させて前記第1の型と第2の型を閉塞し、ポンチを第1の型および第2の型に対して軸方向へ相対的に変位させ、第1の型および第2の型のキャビティを構成する壁部に前記ワークをすえ込み、傘歯車を製造する方法が提案されている。

【0006】さらにもう、特開平7-236937号公報に開示されているように、上ポンチが設けられた上型と、下ポンチが変位自在に設けられた下型とを備え、上型の下降作用下にワークの上部を上ポンチで押圧して一次鍛圧を施し、鍛造素材を製造する傘歯車の少なくとも歯底部分まで流動変位させ、下ポンチをキャビティに進入させてワークを押圧して二次鍛圧を施し、鍛造素材を製造する傘歯車の歯先部分まで流動変位させて傘歯車を製造する方法が提案されている。

【0007】

【発明が解決しようとする課題】上記の従来技術に係る傘歯車の鍛造成形方法では、上型が下型に圧接する際に上型に形成された歯形が、予備成形品の歯形が形成される部位を押圧して変形させる。このため、上型の歯形に強い力が加わり、該上型に形成されている歯形が損傷する懸念があり、上型の耐久性が短くなるという問題があ

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【0008】本発明は前記の課題を解決すべくなされたものであって、上型に形成された歯形に損傷を与えることがなく、上型の耐久性が向上し、且つ鍛造成形時にバリの発生、成形不良が発生することがない傘歯車の鍛造成形方法およびその装置を提供することを目的とする。

【0009】

【課題を解決するための手段】前記の目的を達成するために、本発明は、傘歯車を鍛造成形により成形するための方法において、下ポンチから離間した状態でワークを下型に載置する工程と、下型と上型を当接させ、該上型に形成された歯形を、前記ワークから離間した状態で前記下型と上型を互いに閉塞させる工程と、前記下型と上型とを相対的に前記下ポンチに対して移動させることにより該下ポンチを前記下型と上型との間に画成されたキャビティに進入させて前記ワークを押圧して前記ワークをすえ込み成形する工程と、を有することを特徴とする。

【0010】本発明によれば、下型にワークを載置した際、該ワークは下ポンチから離間している。このワークに上型を下降させ、該上型と下型を互いに閉塞すると、上型に形成された歯形はワークから離間しているため、該歯形には上型と下型とが当接するときの衝撃が加わることがない。そして、下ポンチをキャビティに进入させると、該キャビティ内部のワークは押圧されて塑性変形し、前記上型の歯形に隙間なく流动して傘歯車が成形される。

【0011】この場合、前記ワークは、その下面側に、製造される傘歯車の歯形面のない底面側の雄雌形状が成形された予備成形品であり、前記下型は前記傘歯車の雄雌形状に対応する雌雄形状を有し、前記下型に前記ワークを載置する際、前記ワークの下面側と下型とが係合すると、容易に位置決めすることができ、好適である。また、本発明は、傘歯車を鍛造成形するための装置において、下型と、該下型に対して接近離間自在であり、製造される傘歯車の歯形の雄雌形状に対応した雌雄形状の歯形を有する上型と、前記下型に画成された孔部内に設けられ、該下型に対して相対的に変位自在な下ポンチと、を備え、ワークを前記下型に載置したときに該ワークと前記下ポンチは所定間隔離間し、下型と上型を閉塞させたときに、該上型の歯形は前記ワークと離間していることを特徴とする。

【0012】本発明によれば、ワークを、該ワークと前記下ポンチとが離間している状態で下型に載置し、上型を下降させて該上型と下型を閉塞させる。前記下ポンチをキャビティに进入させると、前記ワークは塑性変形し、前記上型の歯形に隙間なく流动して傘歯車が成形される。また、この場合、前記下型は、製造される傘歯車の歯形面のない底面側の雄雌形状に対応する雌雄形状を有し、製造される前記傘歯車の雄雌形状が形成されたワ

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ークが前記下型と係合すると、ワークを下型のキャビティに載置する際、位置決めが容易になり、好適である。

【0013】

【発明の実施の形態】本発明に係る傘歯車の鍛造成形法について、それを実施する装置との関係において好適な実施の形態を挙げ、添付の図面を参照しながら以下詳細に説明する。本実施の形態では、自動車に使用されるペベルギアを製造する場合を例に挙げて説明する。

【0014】図1において、参照符号10は、本実施の形態に係る傘歯車の鍛造成形装置を示す。この傘歯車の鍛造成形装置10は下型取付部材12を含む。この下型取付部材12の中央部には油圧ユニット14が設けられ、該油圧ユニット14の内部に画成された室16には図示しない圧油供給源から圧油が供給される。前記室16には押圧部材18が上下動自在に設けられ、該押圧部材18は前記圧油によって図において上方に押圧されている。前記押圧部材18の上部には段部20が形成され、該段部20には前記油圧ユニット14の上部に固定された押さえ部材22が係合する。従って、前記押圧部材18は前記押さえ部材22によって上方への移動が抑制されている。前記油圧ユニット14の中央部には筒状部材24が設けられ、該筒状部材24の上端部は前記押圧部材18の中央部に画成された凹部26に嵌入している。該筒状部材24の中央孔部28内にはノックアウトピン30が挿入される。該ノックアウトピン30の上部には当該ノックアウトピン30と同径の円柱部材31が当接し、該円柱部材31の外壁には溝部33が画成され、該溝部33にOリング35が設けられている。前記ノックアウトピン30、円柱部材31は前記凹部26の上部に画成された孔部32からさらに上方に突出している。前記円柱部材31の上端部には該円柱部材31より小径な円柱状の下ポンチ34が固定され、該下ポンチ34の先端部36は上方に向けて縮径してテーパ形状を呈している。

【0015】前記下型取付部材12の上部には支柱38a、38bが立設され、該支柱38a、38bを囲繞してコイルばね40a、40bが設けられる。前記コイルばね40a、40bの上端部は保持プレート42に圧接している。実際、該保持プレート42に画成された孔部44a、44bには前記支柱38a、38bが摺動自在に挿入され、これによって当該保持プレート42は該支柱38a、38bに沿って上下動自在である。従って、前記コイルばね40a、40bは前記下型取付部材12と前記保持プレート42とを互いに離間する方向に付勢していることが容易に諒解されよう。前記保持プレート42の中央には段差のある大孔46が画成され、該大孔46の下部にはポンチホールダ48が嵌入する。該ポンチホールダ48にはフランジ部50が形成されている。該フランジ部50には押さえ部材52が係合し、該押さえ部材52が前記保持プレート42の下部に嵌合することに

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より、前記ポンチホルダ48は保持プレート42に保持されている。該ポンチホルダ48の中央部には前記円柱部材31が摺動自在な凹部54が画成され、該凹部54の上部には当該凹部54より小径な孔部56が画成され、該孔部56には前記下ポンチ34が相対的に摺動自在に挿通する。

【0016】前記ポンチホルダ48に積層されるよう下型58が設けられる。実際、該下型58の外壁には段部60が形成され、該段部60には位置決め部材62が係合し、該位置決め部材62が前記保持プレート42の上部に固定されることにより下型58は前記保持プレート42に位置決め固定されている。前記下型58の中央部には前記孔部56と同軸的に連通する孔部64が画成され、該孔部64には前記下ポンチ34が相対的に摺動自在に挿入される。前記下型58の前記位置決め部材62から突出する外周縁上面には段部66が設けられ、該段部66は上方に向かって僅かに縮径したテーパ状である。前記下型58の中央部分に載置部68が形成され、該載置部68は下方に向けて縮径して前記孔部64と連通する。前記載置部68は製造される傘歯車の歯形と反対側、すなわち傘歯車の歯形面の形成されていない底面側の雄雌形状に対応する雌雄形状に形成されている。

【0017】この鍛造成形装置10は、前記下型取付部材12に対して接近離間自在な上型取付部材70を有する。該上型取付部材70の中央部には孔部72が画成され、該孔部72には上ポンチ74が挿入される。該孔部72は下方に向けて縮径する傾斜部76が形成され、一方、前記上ポンチ74には下方に向けて縮径するテーパ部78が形成されているため、該上ポンチ74は前記上型取付部材70に保持されて孔部72から抜け落ちることが防止される。前記上ポンチ74の下端部には凸部79が形成される。該上型取付部材70の下部には上型80が設けられる。該上型80の外壁には段部82が形成され、該段部82には保持部材84が係合する。前記保持部材84は前記上型取付部材70に固定され、上型80は該保持部材84のフランジ部85によって前記上型取付部材70に位置決め固定される。当該上型80の外周縁下面には該上型80と同心円的に段部86が設けられ、該段部86は下方に向けて僅かに拡径したテーパ状である。前記上型80の下面中央部には凹部88が画成され、該凹部88を構成する壁部には製造される傘歯車の歯形の雄雌形状に対応した雌雄形状の歯形90が形成される。前記上型80には前記凹部88の上方に上型取付部材70の孔部72に連通する孔部92が画成され、該孔部92には前記上ポンチ74が嵌入し、該上ポンチ74の凸部79は前記凹部88の内部に突出している。

【0018】前記上型80が下降して、図2に示すように、下型58を閉塞したときに、前記下型58の載置部68、下ポンチ34の先端部36、上型80の凹部88および凸部79でキャビティ94が画成される。本実施

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の形態に係る傘歯車の鍛造成形装置10は基本的には以上のように構成されるものであり、次にその動作について、本実施の形態に係る鍛造成形方法との関連で以下に説明する。

【0019】先ず、円柱形状のワークに鍛造成形を施して予備成形品100を成形する。このとき、予備成形品100の下部は、製造される傘歯車の歯形面のない底面側の雄雌形状に対応して成形される。以上のような準備工程を経て、図1に示すように、前記予備成形品100は下型58の載置部68に載置される。このとき、前記載置部68は製造される傘歯車の歯形面のない底面側の形状に対応して形成されているため、予備成形品100を載置部68に容易に位置決めすることが可能である。その際、当該予備成形品100の下面是下ポンチ34の先端部36から所定間隔離間している。

【0020】次に、図2に示すように、上型取付部材70と一体化して上型80が下降し、下型58の段部66と上型80の段部86とが嵌合するとともに、該段部66と段部86の夫々のテーパ部分が係合することによって、上型80が下型58に対して位置決めされて該下型58と上型80が閉塞される。その際、上型80の下面と下型58の上面はコイルばね40a、40bの弾发力により圧接される。このとき、上型80に形成された歯形90は予備成形品100の上部から離間しており、該予備成形品100には鍛造成形は施されない。すなわち、前記歯形90と予備成形品100との間には若干の間隙が画成されており、両者は接触していない。従って、該歯形90には力が加わらず、当該歯形90が損傷する懸念はない。また、油圧ユニット14はクッション機能を発揮し、下型58と上型80が当接したときの衝撃を吸収し、該下型58と上型80が損傷することを防止している。

【0021】次いで、図3に示すように、上型80がさらに下降すると、コイルばね40a、40bが縮退して保持プレート42が下降し、下型58と上型80は閉塞した状態で予備成形品100と共に下降し、ポンチホルダ48の下部が押圧部材18の上部と当接する。そして、油圧ユニット14から図示しない圧油供給源を通して圧油が所定量排出され、押圧部材18は室16の内部を下降し、予備成形品100も下降する。このとき、下ポンチ34は下降しないため、該下ポンチ34が下型58に対して相対的に上方に変位することになり、キャビティ94の中に当該下ポンチ34の先端部36が押圧進入する。従って、予備成形品100が塑性変形して載置部68、凹部88および凸部79の夫々の壁部にすえ込まれる。このため、上型80の歯形90の歯先部分まで予備成形品100を構成する素材の一部が流動し、欠肉等の成形不良が発生することがなく、該歯形90に対応する歯形102が形成される。

【0022】また、このとき、上型80と下型58は油

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圧ユニット14とコイルばね40a、40bの弾发力により圧接した状態を維持しているため、予備成形品100の周囲にバリが発生することを防止することができる。以上のようにして予備成形品100に歯形102が成形される。次に、予備成形品100に孔明け加工が施される。この孔明け加工に使用される孔明け装置110について説明する。

【0023】この孔明け装置110は、図4に示すように、ダイホルダ112を備える。該ダイホルダ112の下部にはフランジ部113が形成され、該フランジ部113が図示しない台座に係合して該台座に固定されている。該ダイホルダ112の上部には凹部114が画成され、該凹部114の底部は孔部116と連通している。該孔部116は前記ダイホルダ112の内部で湾曲し、該ダイホルダ112の外側に開口している。前記凹部114には孔明けダイ118が嵌入される。該孔明けダイ118の外周には段部120が形成され、該段部120に押さえ部材122が係合し、該押さえ部材122が前記ダイホルダ112に固定される。従って、孔明けダイ118はダイホルダ112に保持されていることが容易に理解されよう。前記孔明けダイ118の上部には予備成形品100の下部に係合する凹部124が画成されるとともに、該凹部124の中央部には孔部126が画成され、該孔部126は前記孔部116と連通している。

【0024】この孔明け装置110は、前記ダイホルダ112に対して接近離間自在な台座128を有する。該台座128の下部には孔部130a、130bが画成され、該孔部130a、130bに筒状部材132a、132bが前記台座128から下方に延在して固定される。該筒状部材132a、132bの下端部には円盤状の板状部材がねじ134a、134bによって締結され、該板状部材によって筒状部材132a、132bの外壁から外方に突出したフランジ部136a、136bが形成されている。前記孔部130a、130bの終端部近傍には段部138a、138bが形成されており、該段部138a、138bには前記筒状部材132a、132bを纏繞してコイルばね140a、140bの一端部が着座している。

【0025】前記台座128の下部には前記コイルばね140a、140bを纏繞して取付部材142が固定され、該取付部材142の中央部には孔部144が画成され、該孔部144には前記台座128に当接して支持部材146が挿入される。該支持部材146の下部は段部150を経て縮径し、該段部150には前記孔部144に嵌入される押さえ部材152が係合する。該押さえ部材152にはフランジ部153が形成され、該フランジ部153が前記取付部材142にねじ154で固定されることによって、前記支持部材146は抜け止めされる。支持部材146の下部には孔明けポンチ155が固定され、該孔明けポンチ155は前記押さえ部材152

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に画成された孔部156に挿入されている。

【0026】前記取付部材142の下方には保持プレート157が設けられ、該保持プレート157には孔部158a、158bが画成され、該孔部158a、158bには前記筒状部材132a、132bが摺動自在に挿入される。前記孔部158a、158bは段部160a、160bを経て拡径して形成され、該段部160a、160bに前記フランジ部136a、136bが係合して前記保持プレート157は下方への移動が阻止される。一方、前記保持プレート157の上部には前記コイルばね140a、140bの他端部が当接しており、該コイルばね140a、140bは前記台座128と保持プレート157を互いに離間する方向に付勢している。

【0027】前記保持プレート157の中央下部には孔部162が画成され、前記孔部162は段部164を経て下方が拡径して形成される。該孔部162にはストリッパ168が挿入され、該ストリッパ168の外周にはフランジ部170が形成され、該フランジ部170は前記段部164と係合し、ねじ172で締結されることにより、前記ストリッパ168は前記保持プレート157に固定される。前記ストリッパ168の下部には予備成形品100の上部に係合する凹部174が画成される。該凹部174の中央部には孔部176が画成され、該孔部176には前記孔明けポンチ155が摺動自在に挿通する。

【0028】本実施の形態に使用される孔明け装置110は基本的には以上のように構成されるものであり、次に、その動作について説明する。この孔明け装置110の孔明けダイ118に形成された凹部124に歯形102が形成された予備成形品100が載置される。台座128がストリッパ168と一体的に下降すると、該ストリッパ168の凹部174が予備成形品100の上部に係合し、該予備成形品100はストリッパ168に対して位置決めされる。さらに台座128が下降すると、図5に示すように、コイルばね140a、140bは保持プレート157と台座128に押圧されて縮退し、孔明けポンチ155が前記台座128および支持部材146に押圧されて下降し、前記ストリッパ168の孔部176から下方に突出して予備成形品100の上部から進入して打ち抜き、前記予備成形品100に孔部178が画成される。このとき、該孔部178が画成されることによって発生したスクラップ180は、孔明けダイ118に画成された孔部126を挿通して孔部116から外部に排出される。

【0029】以上のようにして傘歯車が製造される。

【0030】

【発明の効果】本発明に係る傘歯車の鍛造成形方法およびその装置によれば、以下の効果ならびに利点が得られる。下型と上型を閉塞する際、予備成形品の上部

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は上型に形成された歯形と接触しないため、上型の歯形が予備成形品を押圧することができなく、上型の歯形が損傷することがない。従って、上型の耐久性が向上し、また、上型が長く使用できるため、製造コストを低廉化することが可能となる。

【0031】さらに、上型に形成された歯形の歯先まで素材が流動するため、欠肉等の成形不良が発生する懸念がなく、上型と下型が圧接しているため、バリの発生も防止することができ、切削加工等を施す必要がなくなる。このため、生産効率が向上する。

【図面の簡単な説明】

【図1】本発明の実施の形態に係る傘歯車の鍛造成形装置を示す縦断面図である。

* 【図2】図1の鍛造成形装置の使用方法を示し、上型と下型が閉塞している状態の縦断面図である。

【図3】図1の鍛造成形装置の使用方法を示し、下ポンチがキャビティに進入している状態の縦断面図である。

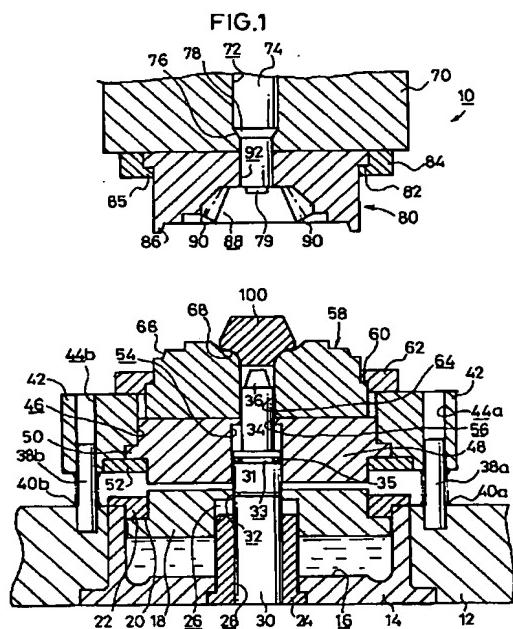
【図4】本発明の実施の形態に係る傘歯車の鍛造成形方法に使用される孔明け装置を示す縦断面図である。

【図5】図4の孔明け装置の使用方法を示す縦断面図である。

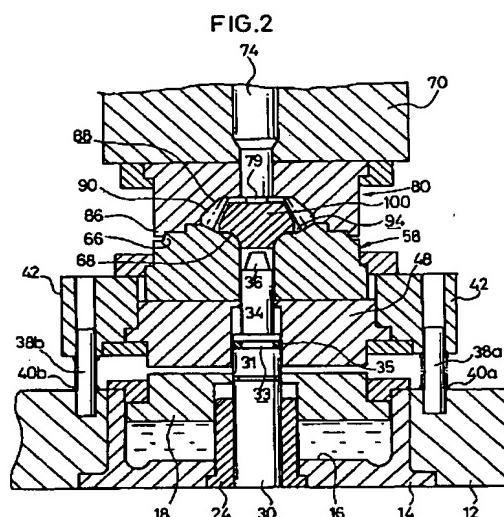
【符号の説明】

10	10…鍛造成形装置	34…下ポンチ
	36…先端部	58…下型
	68…載置部	80…上型
*	90…歯形	100…予備成形品

【図1】



【図2】

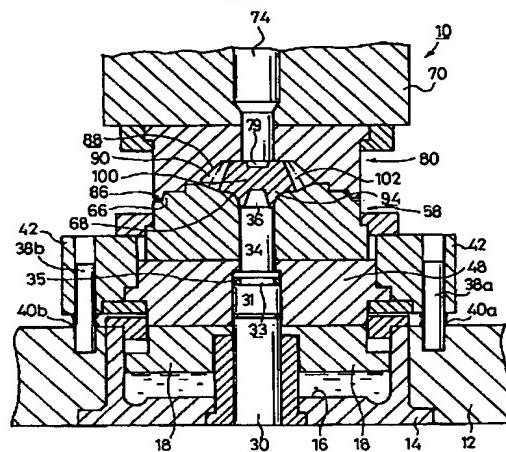


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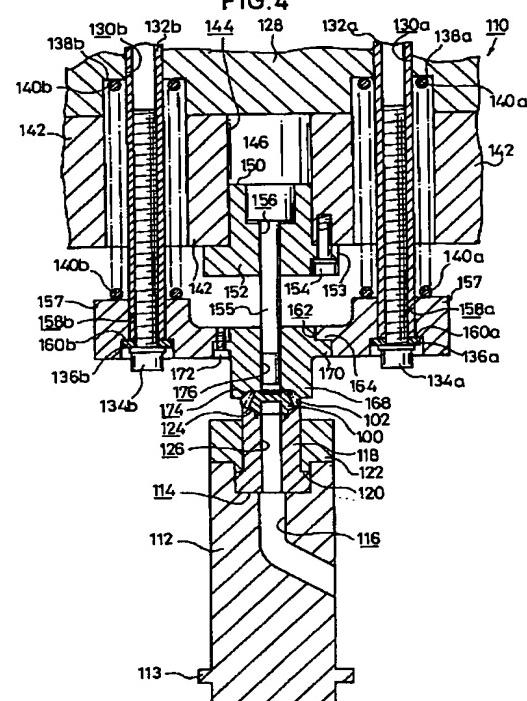
【図3】

FIG.3



【図4】

FIG.4



【図5】

FIG.5

